

# GROUNDWATER ASSESSMENT

## Background

Groundwater is water contained within the open spaces between soil, sand, gravel and till material and within fractures in rock. The water comes from rain and melting snow which soaks through the ground and seeps into formations called aquifers. It usually moves slowly from high places towards low places and ultimately discharges into a nearby surface water body. Generally, the groundwater supply in Maine is adequate. The total withdrawal of groundwater by all water users is much less than the amount that is replaced through rain and snowmelt each year. Maine islands or coastal peninsular communities are areas most likely to experience shortages of groundwater.

More than 60% of Maine households draw their drinking water from groundwater supplied from private or public wells or springs. Public health concerns arise because numerous toxic effects have been linked to contaminants found in groundwater. The primary route of exposure to these contaminants is through ingestion of drinking water. Also, because groundwater commonly discharges to streams and rivers even when there is no rain or snowmelt, environmental impacts include toxic effects on fish, wildlife and aquatic vegetation.

Maine's groundwater quality goal is that all groundwater shall be free of any human-induced pollution that would impair its use as a water supply or its role in supplying surface water resources. Guidelines for groundwater's use as a public drinking water supply are defined by the Maine Department of Human Services (DHS).

Within the DEP, most "site-specific" groundwater monitoring information is obtained either by Department staff, permit-holders, or as a result of enforcement agreements. The BLWQ requires groundwater monitoring at project sites when the activity either poses a risk to groundwater quality or quantity or an adverse impact has already occurred.

Similarly, the DEP Bureau of Remediation and Waste Management (BRWM) requires periodic sampling and reports from various businesses or industries classified as hazardous waste storage facilities or under the terms of enforcement agreements. BRWM also requires groundwater monitoring at all licensed landfills. Some BRWM groundwater monitoring is intended to help locate new water supplies to replace those polluted by leaking underground storage tanks.

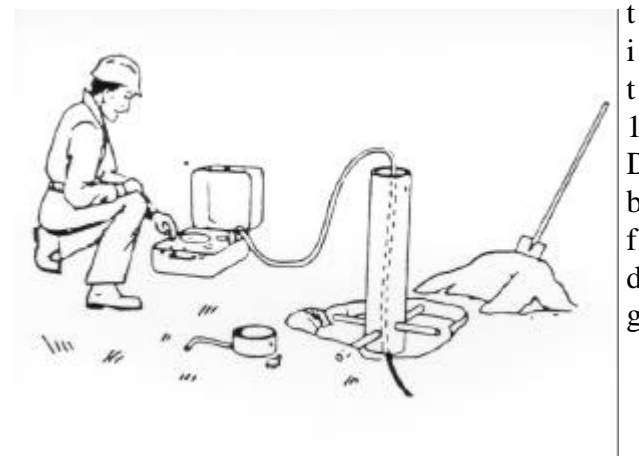
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## Assessment

Contact: John Hopeck, DEP BLWQ, Division of Environmental Assessment, (207) 287-7733 or 3901.

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An accurate assessment of groundwater quality in Maine is difficult since the extent of groundwater contamination is not currently known. The information contained in this section discusses some of the contaminants that have been studied. We know that groundwater in significant areas of the 1% of Maine that is not forested may be threatened by contamination. During the last decade, numerous wells in Maine have been made undrinkable by **nonpoint source pollution** (pages 1 & 7). Centuries may be required or natural processes to restore some contaminated groundwater to drinkable standards. Much of the public is unaware of the threats to groundwater and what they can do to help prevent harm.



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## Groundwater Contamination Sources

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Almost all groundwater contamination in Maine originates from **nonpoint source pollution** rather than **point source pollution**. The Maine Nonpoint Source Pollution Program (page 9) will have the most impact toward reducing groundwater contamination. The program develops **Best Management Practices** (page 9) for activities contributing to nonpoint source pollution. Developing public awareness and use of BMP's are two of the most important aspects of the Nonpoint Source Pollution Program. Some of the nonpoint sources that appear to be responsible for most groundwater contamination in the state are listed at right and discussed in the following section.

- ◆ **Leaking Underground and Above Ground Storage Tanks**
- ◆ **Agriculture**
- ◆ **Hazardous Substance Sites and Generators**
- ◆ **Landfills**
- ◆ **Road Salt Storage and Application**
- ◆ **Shallow Well Injection**
- ◆ **Saltwater Intrusion**
- ◆ **Septic Systems**

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## Leaking underground and above ground storage tanks:

Contact: Bruce Hunter, DEP BRWM, (207) 287-7672.

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Since 1985, all underground storage tanks have been required to be registered with the DEP regardless of size, contents, or use. As of this writing, close to 40,000 tanks have been registered. A small portion remain unregistered, and thousands of inactive tanks have been removed. Nonconforming leaking underground storage tanks (LUST's) are viewed as the biggest threat to groundwater quality in Maine. The most common petroleum product stored in underground storage tanks is fuel oil, followed by gasoline.

### LUST Priority Sites - Contamination Summary

Number of contaminated wells (not including Public Water Supplies)	Number of contaminated Public Water Supplies (PWS's)	Number of threatened wells (not including PWS's)	Number of threatened PWS's
270	11	342	43

**Stricter underground storage tank installation and monitoring standards, removal of old and substandard tanks, and registration of all active and abandoned tanks should continue to reduce discharges from underground storage tanks.**

Home heating oil storage tanks, which are often above ground storage tanks (AST's), are a significant contributor to groundwater contamination due to the leakage of heating oil. DEP staff respond to approximately 200 home heating oil spills a year. DEP has combined efforts with the Pollution Prevention Program and the Maine Oil Dealers Association to educate vendors and owners on how to protect their tanks and operate them safely. Contact: David McCaskill, DEP BRWM, (207) 287-7056.

**In light of the increasing number of AST-related groundwater threats, better tank standards and a statewide spill protection program need to be developed to protect groundwater; also, more outreach is needed to make the public aware of weather and overhead dangers as threats to home heating oil AST's.**

## Agricultural activities:

Contact: Craig Leonard, Maine Department of Agriculture, (207) 287-3117.

for pest control, weed eradication, and fertilization. In addition, many farmers also use manure as fertilizer. Pesticides and nitrates are the main agricultural groundwater contaminants.

**Pesticides.** Contact: Tammy Gould, Maine Board of Pesticide Control (BPC), (207) 287-2731.

Several pesticide studies have been conducted, some by the BPC and the University of Maine. Pesticides have known acute health effects at high concentrations. Because they are generally present in low concentrations in groundwater, most of the concern has been focused on their chronic health effects such as cancer and birth defects. After extensive studies, BPC concluded that pesticide contamination of groundwater appears to be prevalent in areas near active use sites, although it is at levels which does not currently present a health threat to the citizens of Maine.



***Continued development and use of a strategy to protect groundwater from agricultural chemicals will lessen the impact of pesticides and fertilizers on groundwater quality. The BPC expects to begin development of pesticide-specific plans for corn herbicides during 1997-***

**Nitrates.** The documented negative health effects of nitrate (for example, its potential for causing "blue-baby syndrome" in infants) and the number of potential sources for nitrate contamination, may make it the most significant agricultural contaminant in Maine groundwater. Nitrate in agricultural areas results mostly from application of chemical fertilizers and manure to cropland. Manure is spread primarily on corn and hay fields. The impact of typical manure storage and spreading practices on groundwater quality is not well known but merits greater investigation. Between 1993 and 1995, 146 manure complaints were investigated by the Maine Dept. of Agriculture, Food, and Rural Resources (DAFRR). Of the 44 complaints related to drinking water well contamination, 16 concerned elevated nitrate in wells and 28 complaints concerned elevated bacteria.

***Development of new manure application guidelines will decrease the adverse impact of the poultry and dairy farms on groundwater quality.***

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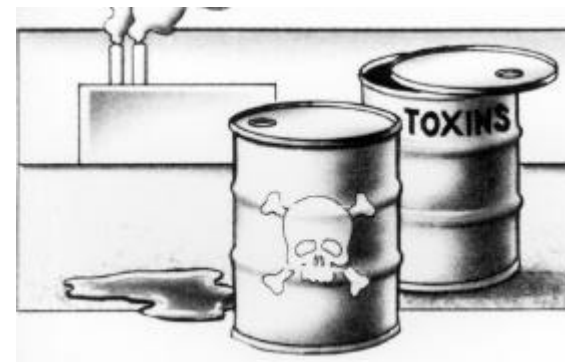
## Hazardous substance sites and hazardous substance generators

Contact: Peter Blanchard, DEP BRWM, (207) 287-7880.

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From 1983, to present, 419 hazardous substance sites have been or are currently being investigated by the BRWM. Twelve sites are listed on the National Priority List of Superfund Sites, including the Brunswick Naval Air Station, McKin disposal site, O'Connor Salvage, Pinette Salvage Yard, Saco Tannery Waste Pits, the Union Chemical site, Winthrop Landfill, Loring AFB, Portsmouth Naval Shipyard West Site, Hows Corner in Plymouth, Eastern Surplus in Meddybemps, and the Saco Municipal Landfill. Common hazardous substances found at these sites include organic solvents, PCB's, and metals. At least 97 drinking water wells have been contaminated at 16 of the sites (data as of 1991) and numerous other wells are at risk.

The BRWM also has 750 active generators of hazardous waste and 500 inactive generators in its tracking system. Approximately 27 wells, both public and private have been affected by groundwater contamination associated with these generators. Public water supply systems in Lisbon and Sanford are two examples of threatened public water supplies. Solvents from an electronics plant have contaminated the Lisbon municipal water supply that serves over 8,000 customers. A pump and treat system has been installed to control migration of the contaminants to the Lisbon aquifer. Contaminant levels at the Lisbon town well have begun to fall. Several manufacturing facilities at the Sanford Industrial Park are suspected as the source of solvents contaminating the town well field which serves over 6,500 customers.



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## Landfills:

Contacts: Paula Clark, DEP BRWM, (207) 287-7718 and Ted Wolfe, DEP BRWM, (207) 287-8552.

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Approximately 1.6 million tons of solid waste were deposited in Maine's landfills in 1991. This waste is generated by residential homeowners, municipalities, and commercial operations. There are two major categories of landfills. Active landfills constitute one category; and inactive municipal landfills that were not closed prior to 1976 are another. The second category poses the most serious threat to groundwater quality. Leachate released from the landfills that have not been finally closed may contain a variety of toxic contaminants that will harm groundwater if the leachate migrates beyond the landfill.



**Investigation and final closure of the older, polluting landfills will reduce one of the most prominent sources of groundwater contamination in the state. Further emphasis on recycling would reduce the waste stream and decrease landfill capacity needs.**

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## Road salt storage and application:

*Contacts: Jeff Canwell, DEP BLWQ, (207) 287-7684 or Christine Olson, Maine Department of Transportation, (207) 287-3323.*

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During the winter, more than 100,000 tons of salt are spread on Maine roads for deicing purposes. The salt is stored in over 700 registered sand-salt storage piles, most of which are uncovered. Leaching of sodium and chloride from uncovered sand-salt storage and spreading has caused substantial groundwater degradation in Maine. DEP field investigations have documented over 130 drinking wells in the state that have become undrinkable by contamination from sand-salt storage. Elevated sodium concentrations may pose a health risk for people on sodium-restricted diets, e.g., people with hypertension.

**Storing sand-salt mixtures for road maintenance in water-tight storage buildings will prevent highly concentrated salty leachate from contaminating groundwater. However, this solution is still nearly a decade from full implementation and state funding for construction has been delayed. Elevated concentrations of sodium and chloride will persist in the groundwater adjacent to roadsides unless an economical substitute for sodium chloride can be found.**

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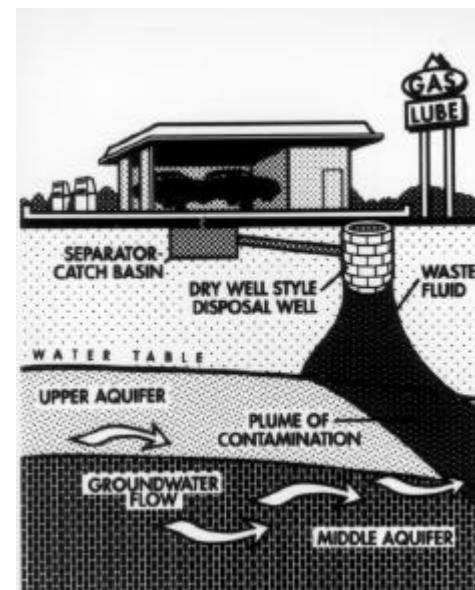
## Shallow well injection:

*Contact: Kim Sargent, DEP BLWQ, (207) 287-6108.*

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Discharge of pollutants by shallow well injection involves disposal of hazardous substances to the groundwater through floor drains. Such discharges have been illegal in Maine since 1983. Injection wells are usually gravity fed, low-technology systems which include cesspools, septic systems, pits, ponds, and lagoons. Industrial and commercial wastes discharged via shallow injection wells include petroleum products, cleaning solvents and degreasers, industrial and agricultural chemicals, storm water runoff, and a variety of other wastes. Because of their high groundwater contamination potential, the DEP has focused most efforts on inventorying and eliminating automobile service station and manufacturing facility floor drains.

Dry cleaning businesses, photoprocessors, and car and truck washes have recently been surveyed for their waste handling practices and the presence of injection wells. Other businesses handling hazardous materials will be targeted for future inspection. These include funeral homes, auto body shops, rustproofers, boatyards, farms, and various laboratories.



**The emphasis of the Underground Injection Control Program on inventory and elimination or control of shallow injection wells should aid groundwater protection efforts. Although the extent of contamination from shallow well injection in Maine is unknown, studies in other states indicate the potential groundwater quality impacts resulting from routine and accidental discharges of toxic and hazardous substances is serious.**

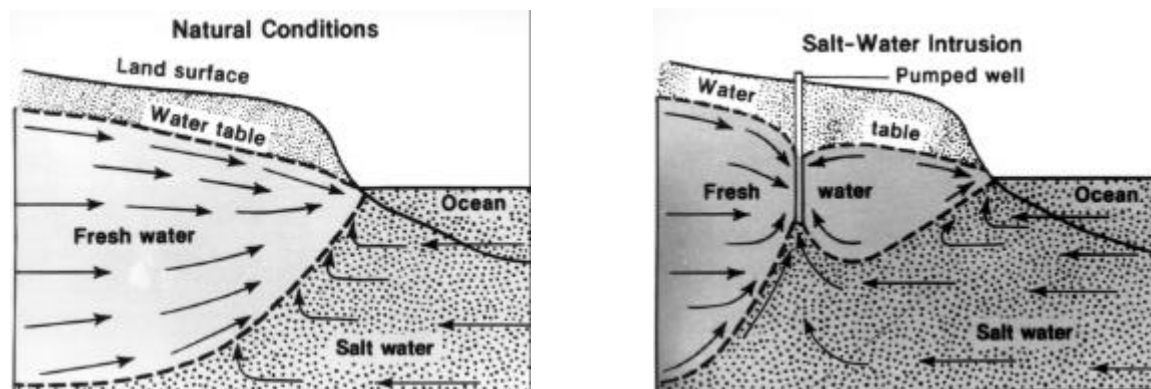
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## Saltwater intrusion:

Contact: Marc Loiselle, Natural Resource Information and Mapping Center/Geology (formerly Maine Geological Survey), (207) 287-2801.

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In coastal areas, excessive groundwater withdrawals and well placements too close to the shoreline may lead to saltwater intrusion. This problem is particularly significant considering that Maine has 5,249 linear miles of coastline and development pressures are great along much of it. Saltwater intrusion is particularly common on coastal peninsulas and off-shore islands that rely primarily on private drilled-bedrock wells for drinking water. For example, a 1982 hydrogeologic study conducted in the town of Harpswell found approximately 70 wells that were being affected by saltwater intrusion. As development pressure along the Maine coast continues, the incidence of saltwater intrusion is expected to increase.



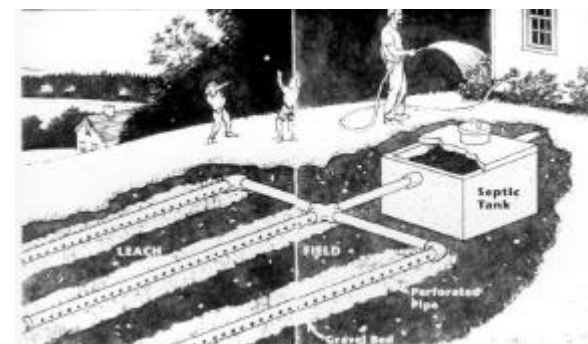
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## Septic systems

Contact: Department of Human Services, Division of Health Engineering, (207) 287-5338.

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The DHS Division of Health Engineering currently regulates septic system design and permitting. Septic systems directly discharge the largest volume of wastewater into the subsurface environment. The major contaminants of concern found in septic system discharge are nitrates, bacteria, and viruses. Wastewater can also contain toxic chemicals from household products. As discussed previously, high concentrations of nitrate may cause methemoglobinemia ("blue-baby syndrome") in infants. Correlations have also been shown between the incidence of stomach cancer and the concentration of nitrate in drinking water. The potential for disease transmission by the microbes discharged by septic systems is a public health concern.



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## Groundwater Quality Trends

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Maine's complex geological setting makes it difficult to generalize about statewide groundwater quality. As a result, water quality data obtained from monitoring wells indicate only the water quality at a specific location and depth in an aquifer. The data reflect the groundwater quality up-gradient of the monitoring well, but they are not indicators of groundwater quality elsewhere, either inside or outside a particular "groundwatershed". Current information about groundwater contamination problems reflect more on the reason for a specific investigation and the manner in which it is conducted, rather than the general groundwater quality of the state.

New occurrences of groundwater contamination are being documented in Maine each year. Although discovery of existing contamination is expected to continue, future contamination is expected to decline substantially as the State conducts groundwater protection initiatives and public education which stress contamination prevention.

Although the Comprehensive State Groundwater Protection Program stresses prevention of contamination whenever possible as the first priority in groundwater protection, this program recognizes that all human activity has an impact on groundwater. Efforts are underway to link contamination sites with populations served by public and private water supply wells, and the quality of surface waters through a computer database system known as **GIS** (Geographic Information System). These databases will allow the state to focus resources where the potential for negative impacts are the greatest.

## Available Publications and Materials

*The DEP has dozens of informative brochures, pamphlets, and booklets on a wide range of topics available free of charge to the public. The following two pages list what is currently accessible and also includes permit materials and applications. To have any of these mailed to you, either indicate the publication(s) that you would like and mail the request, give us a call, or drop by one of our offices. The Central Maine Regional Office is located on Hospital Street in Augusta, adjacent to the Augusta Mental Health Institute. The address and phone number for all DEP BLWQ Regional Offices are listed below.*

<b>Central Maine Regional Office</b> <b>17 State House Station</b> <b>Augusta, ME 04333</b> <b>1-800-452-1942 or</b> <b>287-3901</b>	<b>Northern Maine Regional Office</b> <b>1235 Central Drive</b> <b>Skyway Park</b> <b>Presque Isle, ME 04769</b> <b>764-0477</b>	<b>Southern Maine Regional Office</b> <b>312 Canco Road</b> <b>Portland, ME 04103</b> <b>822-6300</b>	<b>Eastern Maine Regional Office</b> <b>106 Hogan Road</b> <b>Bangor, ME 04401</b> <b>941-4570</b>
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